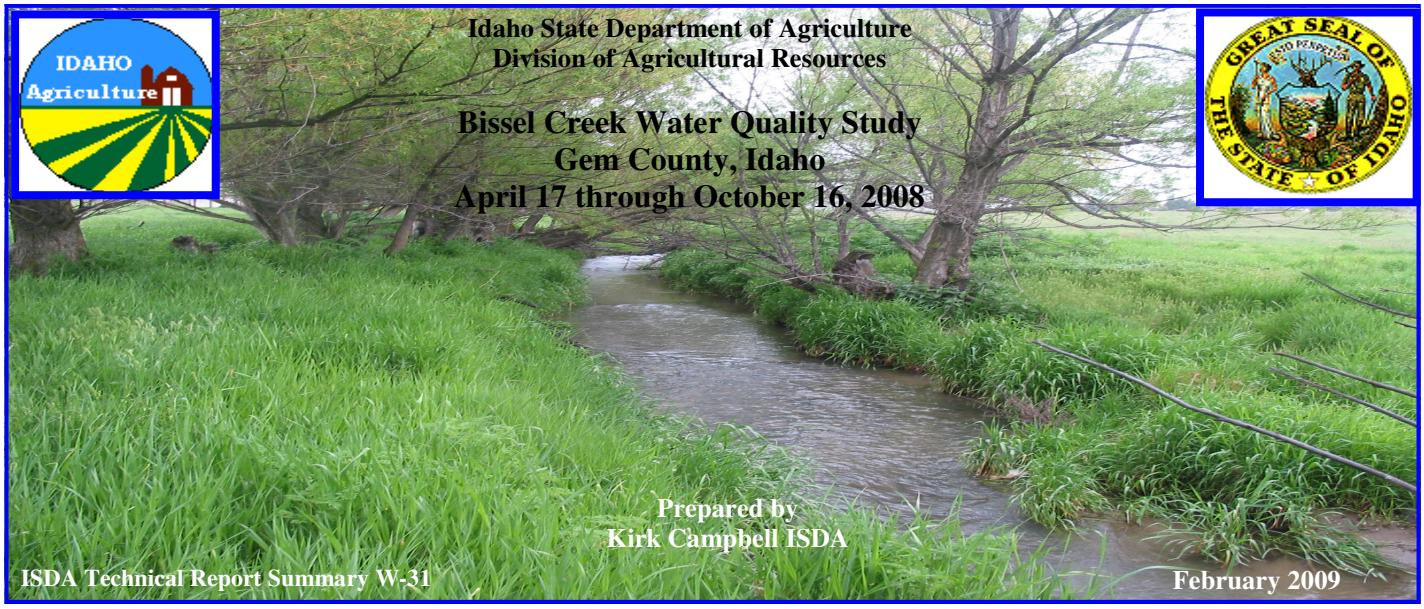

Idaho State Department of Agriculture
Division of Agricultural Resources

Bissel Creek Water Quality Study
Gem County, Idaho
April 17 through October 16, 2008

Prepared by
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ISDA Technical Report Summary W-31

February 2009

Introduction

At the request of the Gem County Soil and Water Conservation District and the Lower Payette Watershed Advisory Group (LPR WAG), the Idaho State Department of Agriculture (ISDA) conducted water quality monitoring on Bissel Creek, located in Gem County, Idaho (Figure 1). Bissel Creek has an established Total Maximum Daily Load (TMDL) for sediment and bacteria (IDEQ, 2003[1]). Numerous monitoring efforts have taken place in the past by ISDA (1996, 1997, and 1998) and the Emmett Irrigation District (2004) to determine the extent of impairment due to sediment and bacteria.

The TMDL encompasses the reach of Bissel Creek from the North Side Canal spill (NC-1) to the Payette River (Figure 1). A portion of Bissel Creek is diverted, just south of W. Idaho Boulevard for irrigation, with the remaining water flowing south towards the Payette River. The flow in Bissel Creek is augmented by overflow water from a man made wetland developed near the Payette River. Bissel Creek then flows south into a large beaver complex. The outlet to the Payette River from the beaver complex is unknown (Figure 2).

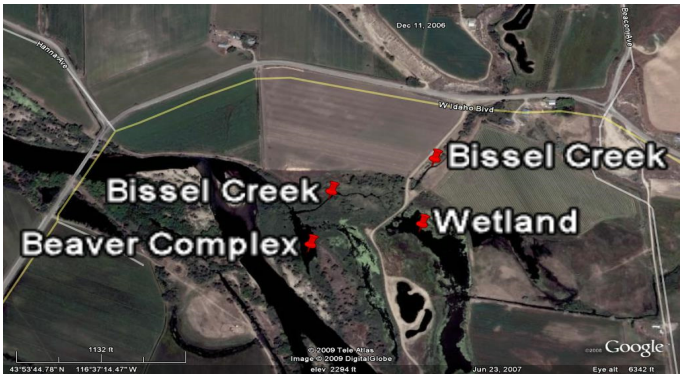

Figure 2. Bissel Creek's route to the Lower Payette River.

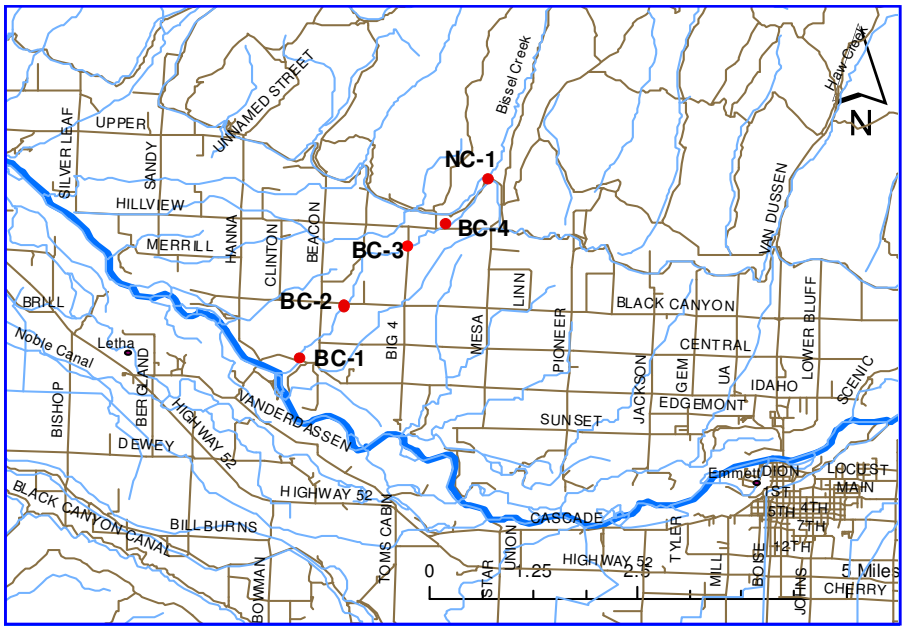

Figure 1. Bissel Creek monitoring sites.

Five monitoring stations were established for the 2008 monitoring effort. The stations were the same five stations used in previous monitoring studies (NC-1 at the Canal, BC-4 at Hillview Rd., BC-3 at Big 4 Rd., BC-2 at Black Canyon Rd., and BC-1 at W. Idaho Blvd. Rd (Figure 1). Monitoring was conducted on a bi-weekly schedule which began on April 17, 2008 and ended on October 16, 2008. Bissel Creek is only TMDL listed for sediment and bacteria. Additional samples were collected to evaluate total phosphorus and dissolved phosphorus (Appendix A). On-site measurements included temperature, dissolved oxygen, conductivity, total dissolved solids, pH, and discharge (Appendix A).

Results

Discharge (CFS)

The upper portion of Bissel Creek (BC-4, and BC-3) receives the majority of its water from spillage from the North Side Canal. The flow at the two lower stations (BC-2, and BC-1) is primarily canal spill water but this area also receives augmentation from irrigation return waters along with recharge from shallow ground water (Figure 3).

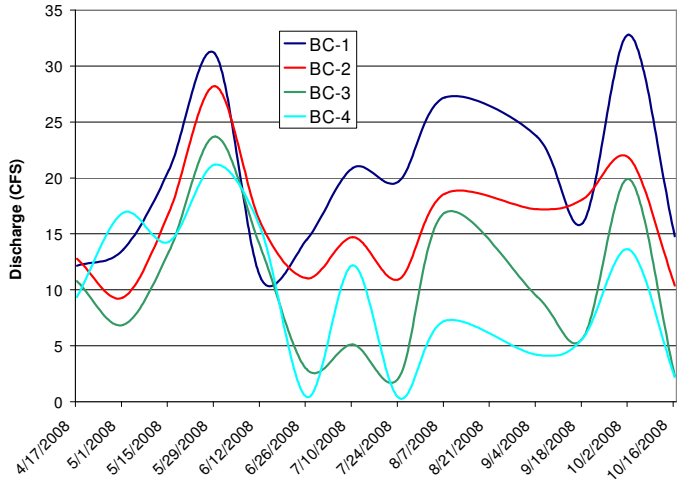

Figure 3. Discharge rates for Bissel Creek.

Figure 3 shows the response in the upper part of the watershed (BC-4) when spill water from the North Side Canal is reduced compared to a lower station (BC-1). Flows on June 26th and July 24th were reduced to 0.43 cfs and 0.34 cfs, respectively. The two lowest stations (BC-1 and BC-2) maintained a higher flow rate primarily due to irrigation return water and inflows of shallow ground water.

Suspended Sediment Concentration (SSC)

The Bissel Creek TMDL sets a sediment average concentration during the irrigation season of 22 mg/L. This low level was established using information from the Succor Creek sediment TMDL (DEQ 2003[2]). The 22 mg/L target is intended to provide protection for the mix of aquatic species that inhabit the stream (IDEQ 2003). Bissel Creek is designated for Cold Water Aquatic Life (CWAL) to protect fish and the aquatic community. As stated in the Bissel Creek TMDL, "Currently, there is a potential fish barrier located approximately one-half mile upstream from the confluence with the Payette River". The barrier is an irrigation diversion structure that appears to prevent the upward movement of fish from the Lower Payette River into Bissel Creek . At this time there is no evidence of a cold water fishery within Bissel Creek or any observations that indicate the presence of any fish species.

Table 1 lists the average SSC concentrations at the four Bissel Creek monitoring stations from April through October and April through September 2008. The Bissel Creek TMDL states that the average of 22 mg/L should be maintained during the irrigation season (April through September). Irrigation activities within the Bissel Creek watershed actually continues through mid-October or until irrigation water is shut off.

Table 1. Bissel Creek average sediment concentrations (mg/L).

Months (2008)	BC-1	BC-2	BC-3	BC-4
April - October	36.6	44.5	39.1	68.2
April - September	39	49.1	42.6	78.5

Research conducted by the Canadian Council of Ministers of the Environment (CCME, 1999) has looked at sediment concentrations and their potential risk to fish and their habitat (Table 2). This potential risk assessment deals with sediment concentration increases over background and does not address duration periods of exposure.

Table 2. Sediment risk to fish and their habitat (CCME 1999).

Sediment increase mg/L	Risk fo fish and their habitat
0	No risk
<25	Very low risk
25-100	Low risk
200-400	Moderate risk
>400	Unacceptable risk

Older research conducted by the European Inland Fisheries Advisory Commission (EIFAC, 1964) deduced the following criteria for suspended solids and the protection of fisheries resources (Table 3).

Given the information provided in Table 2 and Table 3 it seems over protective to establish a sediment threshold of 22 mg/L for Bissel Creek. With no evidence of salmonid activity or any other fish species inhabiting Bissel Creek

the average TMDL sediment concentration appears to be overly restrictive.

Table 3. Suspended Solids effect on Fisheries (EIFAC 1964).

TSS concentration	Effect on Fisheries
<25 mg/L	No evidence of harmful effects on fisheries.
25-80 mg/L	Maintains a good to moderate fisheries.
80-400 mg/L	Unlikely to support good freshwater fisheries.
<400 mg/L	At best, only poor fisheries are likely to be found.

Using the sediment risk assessment proposed by the CCME and graphing the Bissel Creek sediment results helps understand the actual risk associated with sediment in Bissel Creek (Figure 4).

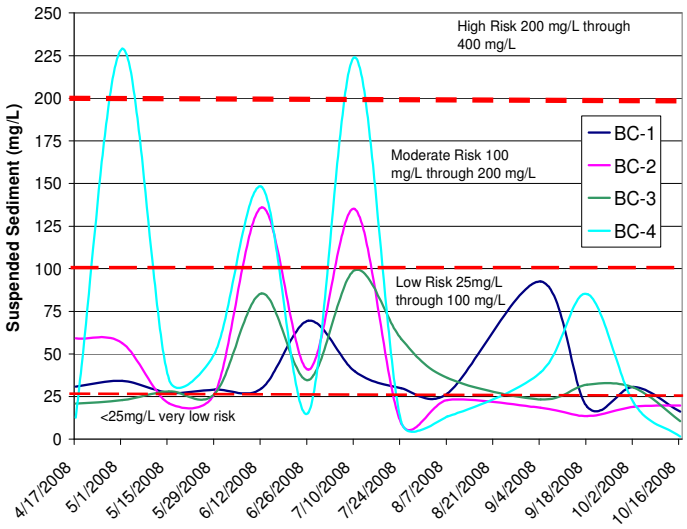

Figure 4. Sediment concentrations Bissel Creek.

Station BC-4 which is the uppermost part of the watershed had two short term events where the peak sediment concentration reached the high risk criteria (200 through 400 mg/L). The other peaks at BC-4 and BC-3 fell within the moderate risk category (100 through 200 mg/L). The remainder of the sediment results fell within the low risk with some concentration falling into the very low risk.

Even with the two high risk peaks at BC-4 during May and July the remainder of the stations remained within the moderate to low risk category.

Sediment loads within Bissel Creek vary throughout the irrigation season. One source of sediment is from poor irrigation practices that erode soils and transport sediment into Bissel Creek. Another possible source is the inconsistent delivery of water, from the north side canal, into Bissel Creek. The varying rate of spill water causes water levels in Bissel Creek to fluctuate up and down which erodes away sediment from the numerous cut banks located along Bissel Creek.

Bacteria- Escherichia Coli (*E-coli*)

Data indicates that Bissel Creek from the North Side Canal to the Lower Payette River is impaired for Primary Contact Recreation due to excessive Escherichia coli (*E-coli)* levels. ISDA evaluated bacteria levels for the 2008 monitoring schedule using the state water quality standard for *E-coli*. The state criteria for *E-coli* (primary contact) is made up of a two step process using a trigger value of 406 colony forming units (CFU) that requires the geomean evaluation of the water body (IDAPA 58.1.02). The 406 CFU value indicates a violation in *E-coli* concentration and requires that 5 samples be collected over a 30 day period to calculate the monthly geomean for *E-coli*. A geomean concentration over 126 CFU indicates a water quality violation.

Data collected by ISDA in 2003 indicated that Bissel Creek exceeded the geomean criteria of 126 CFUs for *E-coli* at all four stations (Table 4).

Table 4. 2003 E-coli geomean results (CFUs).

Date	BC-1	BC-2	BC-3	BC-4	NC-1
7/23/2003	387	291	2400	2400	26
8/5/2003	160	230	840	310	40
8/7/2003	2500	2500	2500	180	20
8/13/2003	310	160	330	80	20
8/19/2003	2500	**5**	20	**5**	40
Geomean	**654**	**168**	**506**	**140**	**28**
Standard	126	126	126	126	126

Data collected in 2008 indicate that Bissel Creek had numerous exceedances of the one time 406 CFU water quality standard (Table 5).

Table 5. E-coli results 2008 Bissel Creek. Gray shaded cells indicate one time exceedance of the 406 CFU standard.

Date	BC-1	BC-2	BC-3	BC-4	NC-1
4/17/2008	490	2400	340	32	
5/1/2008	460	1700	4	3	1
5/15/2008	170	190	2000	88	8
5/29/2008	1100	1600	920	150	38
6/12/2008	820	2400	920	200	33
6/26/2008	730	>2400	2000	550	52
7/10/2008	1100	>2400	2000	2000	20
7/16/2008	650	520	2400	2400	12
7/24/2008	460	340	>2400	440	21
7/30/2008	730	580	>2400	200	6
8/7/2008	1300	920	820	48	6
9/4/2008	460	550	610	88	1
9/18/2008	140	260	650	47	5
10/2/2008	410	390	410	200	3
10/16/2008	81	69	340	10	1

BC-1 and BC-3 exceeded the 406 CFU criteria 80% of the time while BC-2 and BC-4 exceeded the criteria 66% and 27% of the time respectively.

In order to determine if a water quality violation occurred ISDA conducted geomean testing by collecting five samples at all five stations over a 30 day period (Table 6).

Table 6. 2008 *E-coli* geomean results (CFUs).

Dates	BC-1	BC-2	BC-3	BC-4	NC-1
7/10/2008	1100	>2400	2000	2000	20
7/16/2008	650	520	2400	2400	12
7/24/2008	460	340	>2400	440	21
7/30/2008	730	580	>2400	200	6
8/7/2008	1300	920	820	48	6
Geomean	**792**	**554**	**1579**	**459**	**11**
Standard	126	126	126	126	126

With the exception of the North Side Canal (NC-1) all of the Bissel Creek sites exceeded the geomean criteria of 126 CFUs.

Best Management Practices (BMPs)

The Gem County Soil and Water Conservation District with funding support through the Department of Environmental Quality 319 program and the Idaho Soil Conservation Commission Water Quality Program for Agriculture have installed some BMPs within the Bissel Creek watershed (Figure 3).

Figure 3. BMPs implemented within Bissel Creek watershed.

The BMPs installed and the number of acres treated are listed in Table 7.

Table 7. BMPs installed within the Bissel Creek watershed.

Best Management Practices	Tier Number	Acres Treated
Animal Waste Mgmt. System	unknown	unknown
920' fence	1	35
Sediment Basin	1	22
Nutrient Management	1	75
1080' fence	2	unknown
Surge Irrigation System	2	17.7
Surge Irrigation System	3	9

Conclusions

Due to the very low sediment concentration required by the Bissel Creek TMDL (22 mg/L) there may not be sufficient money for BMPs to reach this unrealistic goal. Bissel Creek does not appear to support a cold water fishery therefore it does not warrant such a low sediment allocation. Revisiting the TMDL and setting a more achievable sediment concentration limit should be considered.

Bacteria levels throughout Bissel Creek still appear to be a concern. Given the small number of animal operations within the watershed the major source of bacteria has not been identified. One potential source at the three lower sites (BC-1, BC-2, and BC-3) could be the large population of swallows that nest and raise their young under bridge crossings. At the BC-2 bridge crossing approximately 45 swallow nests were counted under the bridge.

References

Idaho Administrative Code, Department of Environmental Quality. IDAPA 58.01.02., Water Quality Standards.

Idaho Department of Environmental Quality. 2003[1]. Bissel Creek Subbasin Assessment and Total Maximum Daily Load.

Idaho Department of Environmental Quality. 2003[2]. Mid Snake River /Succor Creek Subbasin Assessment and Total Maximum Daily Load.

Canadian Council of Ministers of the Environment. 1999. Canadian water quality guidelines for the protection of aquatic life.

European Inland Fisheries Advisory Commission. 1964. Water quality criteria for European freshwater fish.

Appendix A

BC-1

Date	DO	temp	%SAT	Cond.	TDS	pH	CFS	SSC	TP	OP	e-coli
4/17/2008	11.07	6.8	90.6	438	215	8.05	12.15	30.9	0.214	0.077	490
5/1/2008	11.55	6	92.9	233	114	7.89	13.58	34.2	0.206	0.133	460
5/15/2008	9.62	11	87.2	208.9	102	7.59	20.7	27.3	0.184	0.117	170
5/29/2008	9.53	11.8	88.1	180	88	7.53	31.1	29.1	0.138	0.076	1100
6/12/2008	9.8	10.6	88.1	338	166	7.56	11.01	29.9	0.251	0.155	820
6/26/2008	8.65	14.2	84.5	359	176	7.78	14.5	69.5	0.268	0.163	730
7/10/2008	8.27	15.6	83.1	309	152	7.8	20.9	39.8	0.238	0.169	1100
7/24/2008	8.32	15.3	83.1	383	188	8.1	19.7	29.9	0.188	0.141	460
8/7/2008	7.71	17.4	80.7	275	135	7.93	27.2	27	0.124	0.102	1300
9/4/2008	8.73	12.6	82.2	345	169	7.53	23.7	92.5	0.274	0.122	460
9/18/2008	8.28	13.6	79.7	430	231	7.69	16	19	0.207	0.156	140
10/2/2008	8.29	14.2	80.8	265	130	7.71	32.8	30.7	0.148	0.091	410
10/16/2008	9.43	11	85.3	474	232	na	14.8	16.1	0.168	0.13	81

BC-2

Date	DO	temp	%SAT	Cond.	TDS	pH	CFS	SSC	TP	OP	e-coli
4/17/2008	10.7	7.5	88.9	164	81	7.86	12.78	59.1	0.2	0.059	2400
5/1/2008	11.39	6.1	91.9	171.5	84	7.71	9.32	56.4	0.259	0.154	1700
5/15/2008	9.88	10.7	89	151	74	7.83	16.9	21.1	0.141	0.085	190
5/29/2008	9.27	11.7	85.4	136.4	67	7.63	28.2	27.4	0.133	0.069	1600
6/12/2008	9.29	10.3	83	197.1	97	7.76	15.9	136	0.388	0.12	2400
6/26/2008	8.21	14.2	80	317	155	7.6	11.03	40.8	0.262	0.187	>2400
7/10/2008	7.75	15.7	78	286	140	7.76	14.7	135	0.305	0.149	>2400
7/24/2008	8.1	15.2	80.6	379	186	7.78	10.95	9.3	0.182	0.146	340
8/7/2008	7.32	17.5	76.9	222	109	7.83	18.6	23	0.143	0.094	920
9/4/2008	8.35	12.6	78.5	299	146	7.74	17.2	18.4	0.162	0.121	550
9/18/2008	7.56	13.7	72.8	398	195	7.73	18.1	13.6	0.254	0.153	260
10/2/2008	7.91	14	77	241	118	7.56	21.8	19	0.124	0.078	390
10/16/2008	8.47	11	76.9	429	210	na	10.4	19.8	0.159	0.119	69

BC-3

Date	DO	temp	%SAT	Cond.	TDS	pH	CFS	SSC	TP	OP	E-coli
4/17/2008	11.06	7.7	92.6	70.6	35	7.91	10.77	20.9	0.083	0.024	340
5/1/2008	11.99	5.9	96.1	73.1	36	7.86	6.87	22.9	0.234	0.159	4
5/15/2008	10.8	10.1	96	58.8	29	7.98	13.4	28.1	0.107	0.038	2000
5/29/2008	10.11	11.5	92.8	55.2	27	7.62	23.7	27	0.085	0.032	920
6/12/2008	10.25	10.6	92.1	72.5	36	7.82	13.7	85.5	0.144	0.036	920
6/26/2008	8.26	15.7	83.2	95.6	47	7.53	2.88	34.7	0.226	0.134	2000
7/10/2008	8.07	18.5	86.1	76	37	7.78	5.12	99.1	0.236	0.133	2000
7/24/2008	8.19	17.4	85.5	125	61	7.63	2.17	58.9	0.161	0.087	>2400
8/7/2008	8.1	19.6	88.3	69	34	7.86	16.9	35.9	0.112	0.041	820
9/4/2008	9.41	12.7	88.8	109	53	7.87	9.43	23.3	0.11	0.065	610
9/18/2008	8.88	14.1	86.3	154	76	7.52	5.68	32	0.138	0.073	650
10/2/2008	9.23	13.9	89.3	101	50	7.57	19.9	30.2	0.095	0.026	410
10/16/2008	10.46	9	90.4	163	80	na	2.29	10.6	0.065	0.035	340

BC-4

Date	DO	temp	%SAT	Cond.	TDS	pH	CFS	SSC	TP	OP	E-coli
4/17/2008	10.87	8.2	92.3	71.1	35	7.89	9.37	12.6	0.073	0.021	32
5/1/2008	11.87	6.7	97.1	61.8	30	7.8	16.89	229	0.21	0.031	3
5/15/2008	10.85	10.1	96.4	57.1	28	7.93	14.3	35.5	0.088	0.026	88
5/29/2008	10.13	11.5	93.2	47.4	23	7.62	21.2	51	0.101	0.023	150
6/12/2008	10.38	10.9	93.9	62.1	30	7.8	15.4	148	0.203	0.019	200
6/26/2008	8.34	15.8	84	55.2	27	7.6	0.43	15.6	0.077	0.047	550
7/10/2008	8.11	20.1	89.4	52	26	7.9	12.2	224	0.235	0.041	2000
7/24/2006	8.47	17.3	88.4	59	29	7.81	0.34	10.1	0.065	0.04	440
8/7/2008	8.23	20.3	91.1	54	27	7.82	7.24	13.3	0.032	0.019	48
9/4/2008	9.6	14	93.2	59	29	7.85	4.2	39.3	0.085	0.033	88
9/18/2008	9.31	14.5	91.5	65	32	7.64	5.68	85.2	0.145	0.056	47
10/2/2008	9.65	14.1	93.9	73	36	7.63	13.6	21.2	0.051	0.014	200
10/16/2008	11.28	8.8	97.2	86	42	na	2.2	1.49	0.017	0.01	10